## Features

- PWM Buck Control Circuitry
- Operating voltage can be up to 20V
- Under voltage Lockout (UVLO) Protection
- Short Circuit Protection (SCP)
- Soft-start circuit
- Variable Oscillator Frequency -- 300Khz Max
- 0.77V voltage reference Output
- 8-pin SOP package
- SOP-8L: Available in “Green” Molding Compound (No Br, Sb)
- Lead Free Finish/ RoHS Compliant (Note 1)

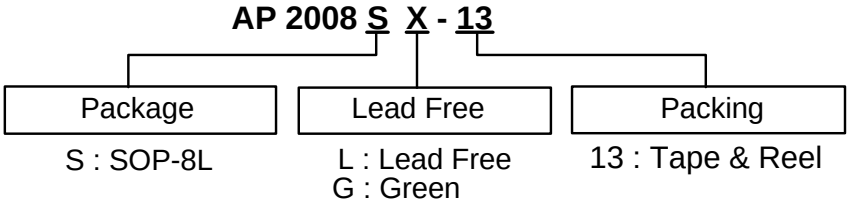
## General Description

The AP2008 integrates Pulse-Width-Modulation (PWM) control circuit into a single chip, mainly designs for power-supply regulator. All the functions include an on-chip 0.77V reference output, an error amplifier, an adjustable oscillator, a soft-start, UVLO, SCP circuitry, and a push-pull output circuit. Switching frequency is adjustable by trimming CT. During low VCC situation, the UVLO makes sure that the outputs are off until the internal circuit is operational normally.

## Applications

- Backlight inverter
- LCD Monitor
- XDROM, XDSL Product
- DC/DC converters in computers, etc.

## Ordering Information

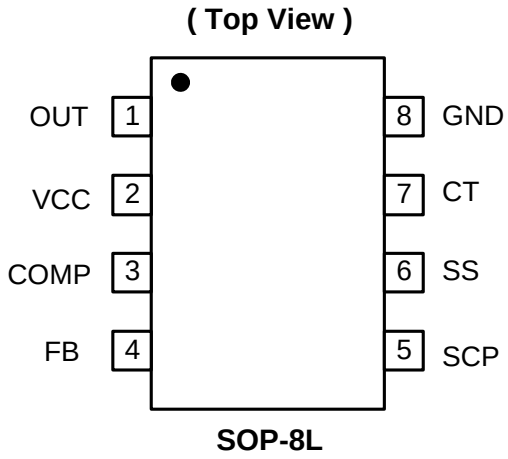



| Device | Package Code | Packaging (Note 2) | 13” Tape and Reel | |
|---|---|---|---|---|
| | | | Quantity | Part Number Suffix |
| AP2008SL-13 | S | SOP-8L | 2500/Tape & Reel | -13 |
| AP2008SG-13 | S | SOP-8L | 2500/Tape & Reel | -13 |

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at http://www.diodes.com/products/lead_free.html.
2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.


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## Pin Assignments

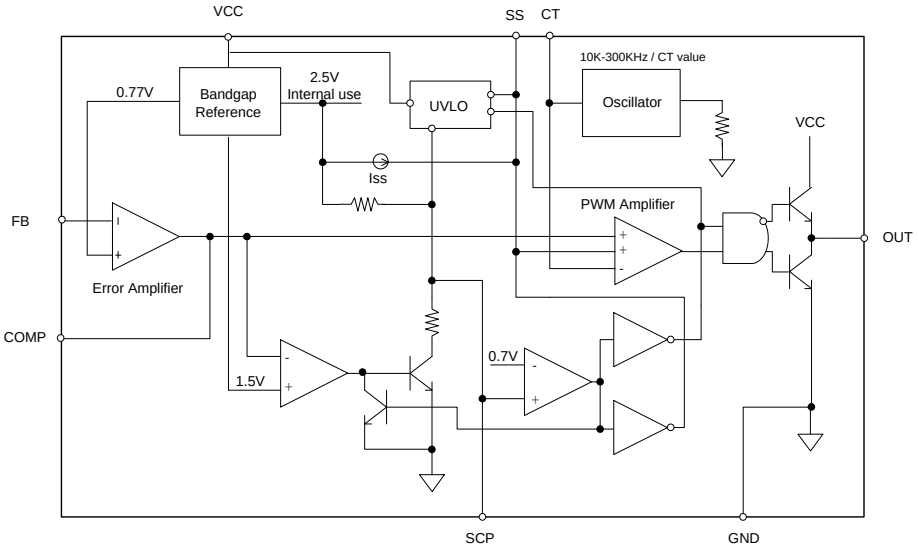



## Pin Descriptions

| Pin Name | Description |
|---|---|
| OUT | PWM Output |
| VCC | Supply Voltage |
| COMP | Feedback Loop Compensation |
| FB | Voltage Feedback |
| SCP | Short Circuit Protection |
| SS | Soft-Start. |
| CT | Timing Capacitor |
| GND | Ground |


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## Block Diagram




## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{CC}$ | Supply voltage | 22 | V |
| $V_I$ | Amplifier input voltage | 20 | V |
| $V_O$ | Collector output voltage | $V_{CC}$-1.0V | V |
| $I_{SOURCE}$ | Source current | 200 | mA |
| $I_{SINK}$ | Sink current | 200 | mA |
| $T_{OP}$ | Operating temperature range | -20 to +85 | $^oC$ |
| $T_{ST}$ | Storage temperature range | -65 to +150 | $^oC$ |

## Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | 3.6 | 20 | V |
| $V_I$ | Amplifier input voltage | 1.05 | 1.45 | V |
| $V_O$ | Collector output voltage | | Vcc-1.5 | V |
| $I_{FB}$ | Current into feedback terminal | | 45 | μA |
| $R_F$ | Feedback resistor | 100 | | kΩ |
| $C_T$ | Timing capacitor | 100 | 6800 | pF |
| $F_{OSC}$ | Oscillator frequency | 10 | 300 | KHz |


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## Electrical Characteristics ($T_A$=25°C, $V_{CC}$=6V, f=200 Khz)

**Reference (REF)**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{REF}$ | Comp connect to FB | | 0.755 | 0.770 | 0.785 | V |
| | Output voltage change with temperature | $T_A$ = -20°C ~ 25°C | | -0.1 | ±1 | % |
| | | $T_A$ = 25°C ~ 85°C | | -0.2 | ±1 | % |

**Under voltage lockout (UVLO)**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{UT}$ | Upper threshold voltage ($V_{CC}$) | $I_{O(REF)}$ = 0.1mA<br>$T_A$ = 25°C | | 2.9 | | V |
| $V_{LWT}$ | Lower threshold voltage ($V_{CC}$) | | | 2.4 | | V |
| $V_{HT}$ | Hysteresis ($V_{CC}$) | | | 500 | | mV |

**Short-circuit protection (SCP) control**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IT}$ | Input threshold voltage | $T_A$ = 25°C | 0.60 | 0.67 | 0.75 | V |
| $V_{STB}$ | Standby voltage | No pull up | 100 | 130 | 160 | mV |
| $V_{LT}$ | Latched input voltage | No pull up | | 50 | 100 | mV |
| $I_{SCP}$ | Input (source) current | $V_I$ = 0.7V, $T_A$ = 25°C | -10 | -15 | -20 | µA |
| $V_{CT}$ | Comparator threshold voltage (COMP) | | | 1.5 | | V |

**Oscillator (OSC)**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $F_{OSC}$ | Frequency | $C_T$ =270 pF | | 200 | | KHz |
| $\Delta F_{OSC}$ | Standard deviation of frequency | $C_T$ =270 pF | | 10 | | % |
| | Frequency change with voltage | $V_{CC}$=3.6V ~ 20V | | 1 | | |

**Error-amplifier**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | $V_O$ (FB)=0.77V | | | ±6 | mV |
| $I_{IO}$ | Input offset current | $V_O$ (FB)=0.77V | | | ±100 | nA |
| $I_{IB}$ | Input bias current | $V_O$ (FB)=0.77V | | 160 | 500 | nA |
| $V_{CM}$ | Common-mode input voltage range | $V_{CC}$=3.6V ~ 20V | 1.05 | | 1.45 | V |
| AV | Open-loop voltage amplification | $R_F$=200 kΩ | 70 | 80 | | dB |
| GBW | Unity-gain bandwidth | | | 1.5 | | MHz |
| CMRR | Common-mode rejection ratio | | 60 | 80 | | dB |
| $V_{OH}$ | Max. output voltage | | $V_{ref}$-0.1 | | | V |
| $V_{OL}$ | Min. output voltage | | | | 1 | V |
| $I_{OI}$ | Output (sink) current (COMP) | $V_{ID}$ = -0.1V, $V_O$ = 0.77V | 0.5 | 1.6 | | mA |
| $I_{OO}$ | Output (source) current (COMP) | $V_{ID}$ = 0.1V, $V_O$ = 0.77V | -45 | -70 | | µA |


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## Electrical Characteristics (Continued) ($T_A$=25°C, $V_{CC}$=6V, f=200 Khz)

**Output section**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{LEAK}$ | Leakage current | $V_O$ = 20V | | | 10 | μA |
| $I_{DRV}$ | Sink current | $V_{IN}$= 12V | | 200 | | mA |
| | Source current | $V_{IN}$= 12V | | 200 | | mA |
| $V_{SAT}$ | Output saturation voltage | $I_O$ = 10 mA | | 1.0 | 1.5 | V |
| $I_{SC}$ | Short-circuit output current | $V_O$ = 6V | | 120 | | mA |

**PWM comparator**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{T0}$ | Input threshold voltage at f = 10 KHz (COMP) | CT=6800pF | | 0.6 | 0.7 | V |
| $V_{T100}$ | | Maximum duty cycle | 1.2 | 1.3 | | V |

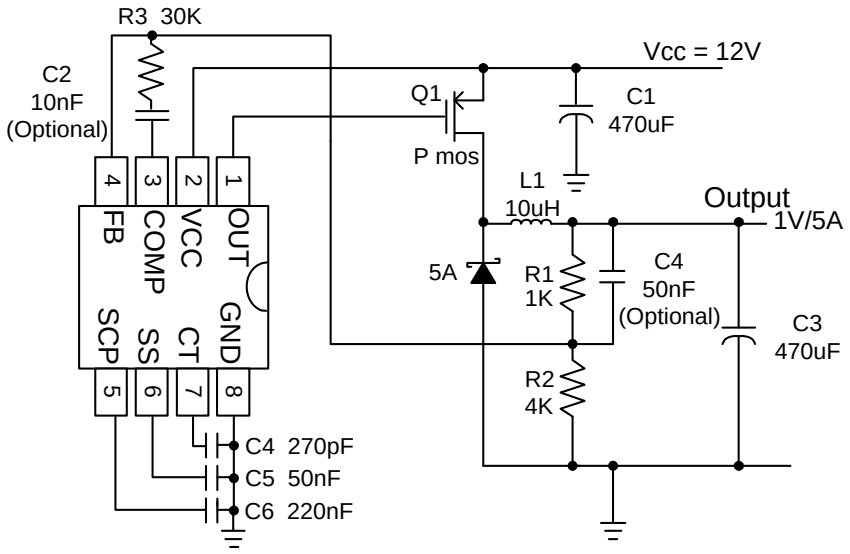
**Total device**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CCA}$ | Average supply current | $C_T$ = 270pF | | 6 | 10 | mA |

**Soft Start**

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SS}$ | Soft-start Voltage | | | 2.3 | | V |
| $I_{SS}$ | Constant Charge Current | | | 20 | | μA |

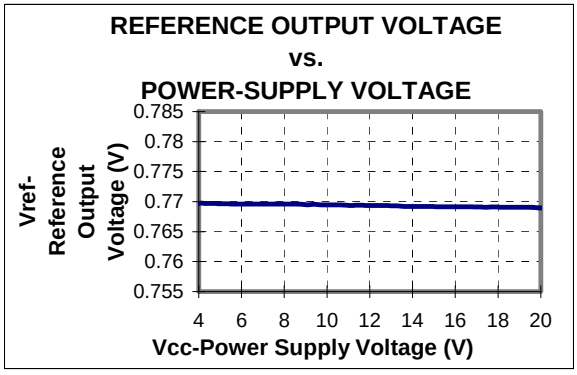
## Typical Application Circuit

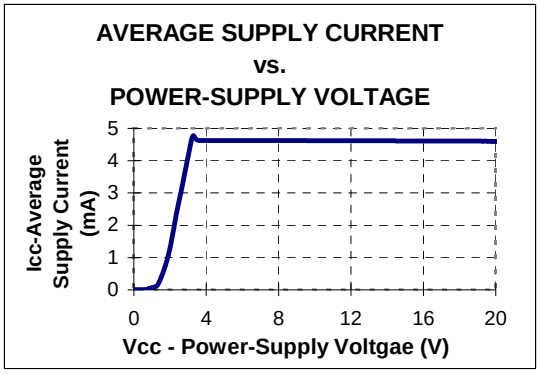


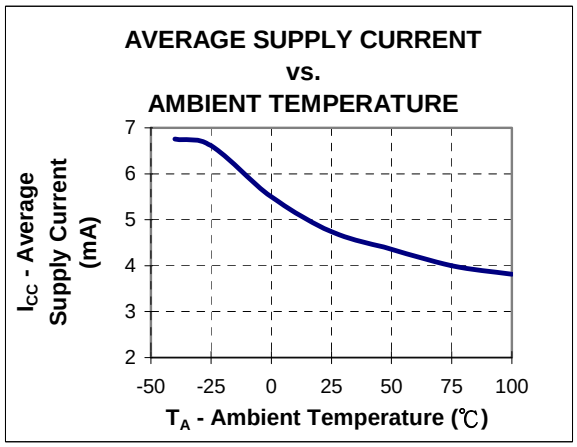

**Step-Down DC/DC converter**

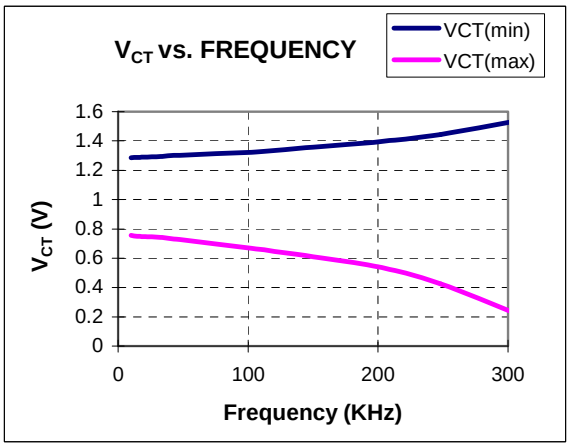

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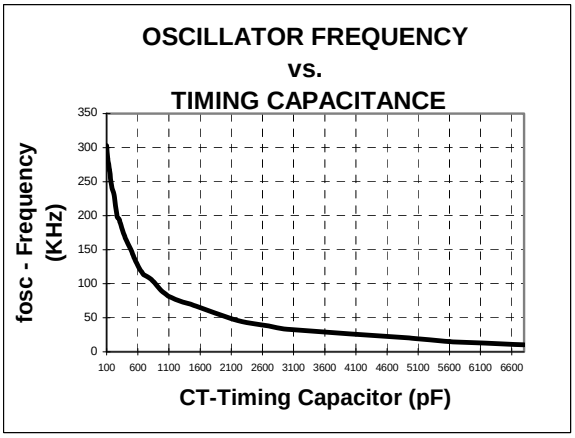
## Typical Characteristics

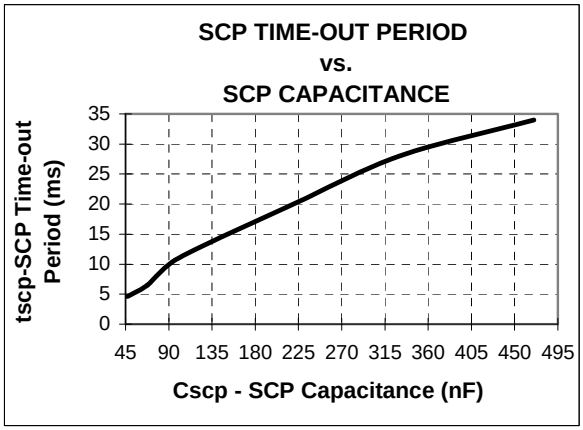


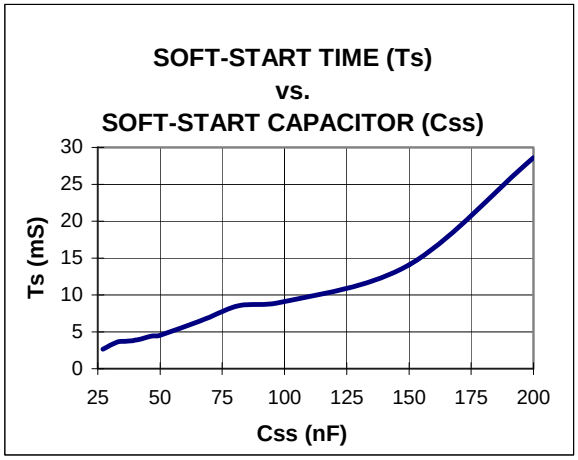





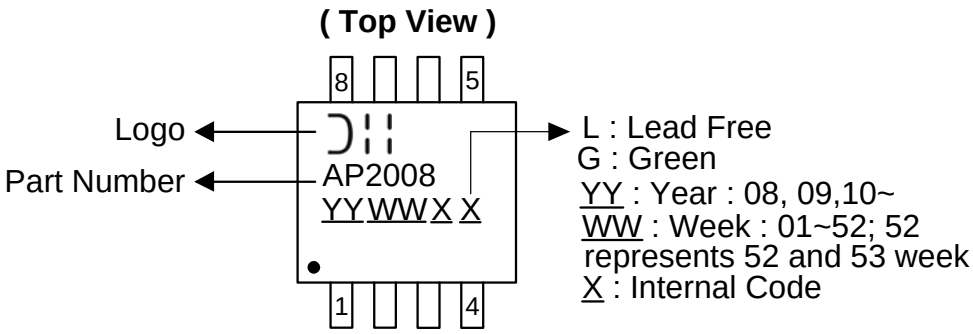
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## Typical Characteristics (Continued)




## Marking Information

**(1) SOP-8L**

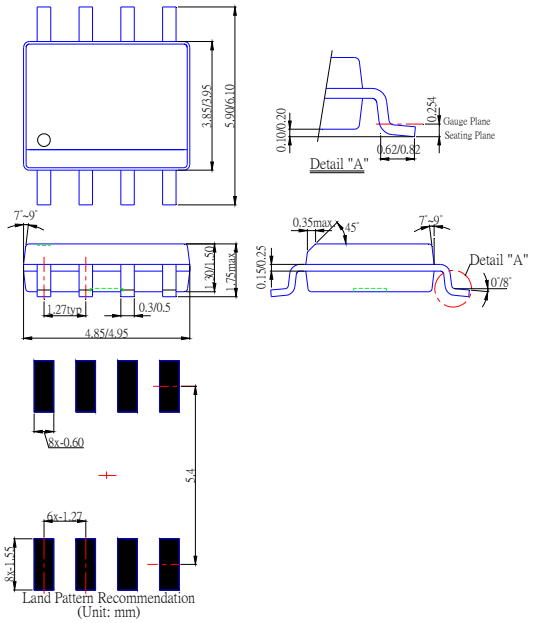




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## Package Information (All Dimensions in mm)

### (1) Package Type: SOP- 8L




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